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EVALUATION OF THE AN/SQS-T3 SHIPBOARD SONAR TRAINER.(U)
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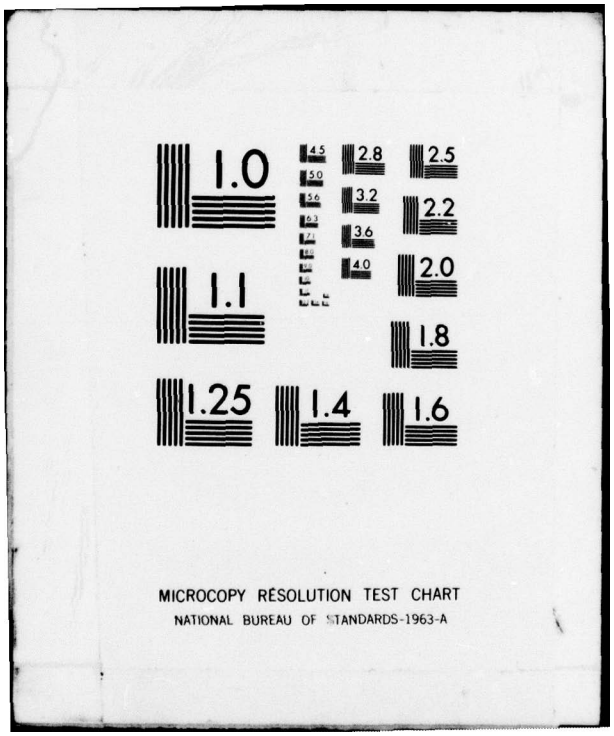
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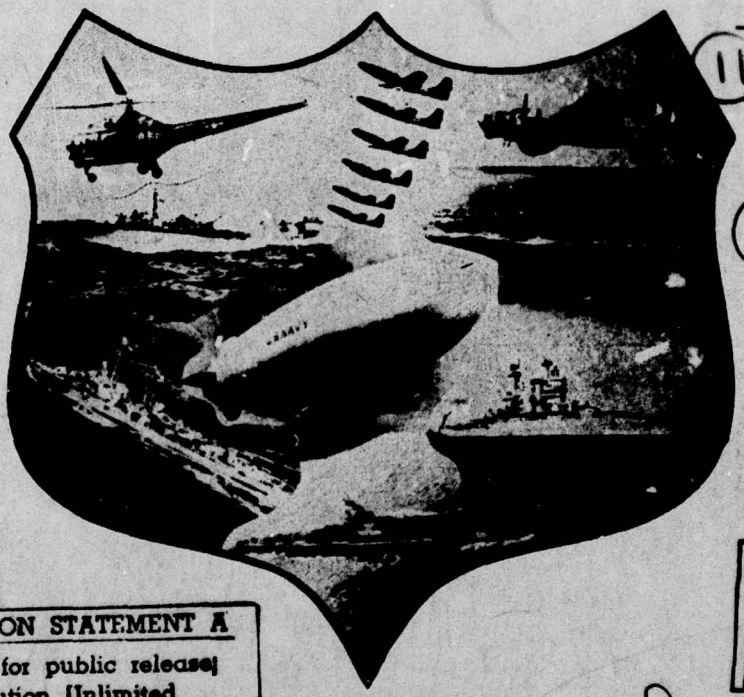
EVALUATION OF THE AN/SQS-T3 SHIPBOARD SONAR TRAINER.



9 FINAL REPORT.

ON PROJECT OP/S2.6/S68

PREPARED AND SUBMITTED BY

COMMANDER OPERATIONAL DEVELOPMENT FORCE

UNITED STATES ATLANTIC FLEET
OPERATIONAL DEVELOPMENT FORCE
U. S. Naval Base
Norfolk 11, Va.

IN REPLY REFER TO:
(32:jhs)
FF 5-7/ J15-11
Ser 01258

CONFIDENTIAL

14 December 1954

From: Commander Operational Development Force
To: Chief of Naval Operations

Subj: Final Report on Project Op/S276/S68, "Evaluate the AN/SQS-T3 Shipboard Sonar Trainer", submission of

1. The subject report is forwarded herewith.

2. There have been no previous reports submitted on this project.

3. This report is considered to terminate the subject project and cancellation is requested.

4. Commander Operational Development Force maintains stock of these reports to meet requests for copies after original distribution. To reduce the resultant reprinting of reports, it is requested that this copy be returned to Commander Operational Development Force if and when no longer needed.

H. D. BAKER

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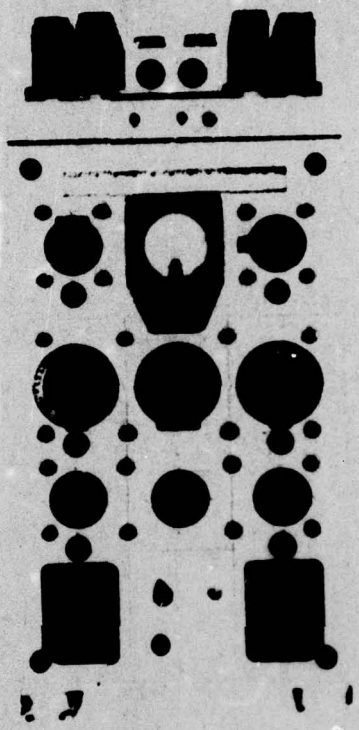
ABSTRACT



1. Tests at sea and in port were conducted with the AN/SQS-T3 sonar trainer installed in USS FRANCIS M. ROBINSON (EDE 220) during August and September 1954 to determine the utility of the equipment as an A/S operator and team trainer, and to determine the effect of the installation and operation of the trainer on the performance of the installed sonar.

2. The AN/SQS-T3 sonar trainer is a small, compact, relatively simple equipment which introduces a synthetic submarine target into

the audio and video indicating channels of a scanning sonar. No highly experienced operators for maintenance and operation of the trainer are required.

3. It was concluded from the tests that the trainer as presently designed affords excellent training for the A/S team in single ship attack. The following synthetic target deficiencies limit its utility as an operator trainer, both for the sonar and the range recorder operators:

a. Insufficient variation of signal strength with range.

b. Insufficient variation in trace length, audio echo, and video pip with pulse length.

c. Insufficient variation in trace length, audio echo, and video pip with target aspect.

d. Poor performance of the random fader circuit.

e. Inadequate slaving of generated signal strength to the sonar gain control.

4. It is recommended that the trainer be modified to correct these deficiencies. Subject to correction of at least a. and b. above, acceptance of the trainer for service use is recommended.

INDEX

Enclosures (1) through (3)

LIST OF REFERENCES

(a) COMOPDEVFOR ltr ser 1784 of 17 September 1952 - Project assignment to SURASDEVDET

(b) NAVSHIPS 91274(A) - Instruction Book for Sonar Training Set AN/UQS-T1

(c) CO, SURASDEVDET ltr ser 055 of 19 February 1953 with COMOPDEVFOR 1st end ser 0239 of 12 Mar 53 - Preliminary equipment report

(d) USL Report No. 187 - QHBa Figure-of-Merit Tests

(e) USL Technical Memorandum No. 1230-0185-52 of 1 December 1952 - The Procedures for QHB Figure-of-Merit Equipment

(f) CNO ltr ser 0298P37 of 6 May 1953 - Suspend the operational evaluation pending receipt of a pre-production model

(g) Interim Utilization Manual for the Shipboard Sonar Training Set AN/SQS-T3 (Development Model) (prepared by NEL)

(h) Technical Data for Sonar Trainer AN/SQS-T3 of 1 July 1952 (prepared by the Technical Development Corporation for the Bureau of Ships)

(i) NEL Report 343 (Service Test), Shore-based Evaluation of the Shipboard Trainer AN/SQS-T3 (XN-1)

LIST OF ENCLOSURES

(1) Copy of CNO ltr ser 937P37 of 3 September 1952 - Project Assignment to COMOPDEVFOR.

(2) Series of Scope photographs of submarine and T3 trainer synthetic targets while using MCC.

(3) Scope photographs of submarine and T3 trainer synthetic targets at various aspects and ranges.

PURPOSE OF TEST

Tests at sea and in port were conducted with the AN/SQS-T3 Shipboard Sonar Trainer utilizing the AN/SQS-11A sonar, in USS FRANCIS M. ROBINSON (EDE 220) to:

1. Determine whether the moving synthetic submarine target, provided by the trainer, gives a realistic simulation of an actual submarine target to the audio and video indicating channels of a conventional scanning sonar equipment.

2. Determine whether all sonar operator controls operate in a normal manner when the trainer is in use.

3. Determine whether the material performance of the sonar equipment is affected by use of the trainer.

4. Obtain an estimate of the utility of the trainer in ASW search, tracking and attack techniques and procedures both as an operator and a team trainer.

PREVIOUSLY KNOWN DATA

1. The AN/UQS-T1 Sonar Trainer described in reference (b) has been in service use for two years. It is a larger and more complex trainer than the AN/SQS-T3, and is for use on tenders and at shore activities.

2. A shore based evaluation of the functional performance of the AN/SQS-T3 was conducted by the U.S. Navy Electronics Laboratory. The report of this evaluation is in preparation.

3. A pre-prototype model of the AN/SQS-T3 previously installed in USS JACK W. WILKE (EDE 800) on 24 October 1952 was unsuitable primarily because of the poor component construction and configuration. Details are contained in the preliminary equipment report (reference (c)).

DESCRIPTION OF TEST MATERIAL

1. The AN/SQS-T3 Shipboard Sonar Trainer is designed to operate in conjunction with a scanning sonar installation aboard ship. The trainer supplies synthetic sonar echoes from an artificial target to the audio and video indicating channels of the scanning sonar without interrupting the normal operation of the sonar transmitter and receiver. Controls are provided for changing target course, speed, depth, turning rate and acceleration rate at any point throughout the problem. In addition, the trainer generates signals representing the change in position of own ship in the north-south and east-west directions. The course and speed of own ship may be inserted manually by controls on the trainer chassis or may be obtained from the ship's gyro compass and pit log.

2. The trainer assembly consists of a problem generator, a sonar target simulator and the required DC power supplies, all of which are assembled in a "breakaway" type cabinet. The front panel assembly is mounted on hinges and swings open to the left (see Figure 1). This assembly consists of the control panel and a casting upon which are mounted the rotary equipment and gear trains of the problem generator.

3. The electronic components of the problem generator are mounted as plug-in-type units on the inside rear wall of the cabinet (see Figure 2).

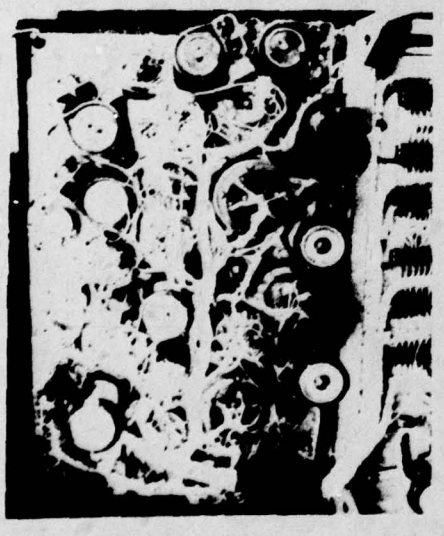


Figure 1

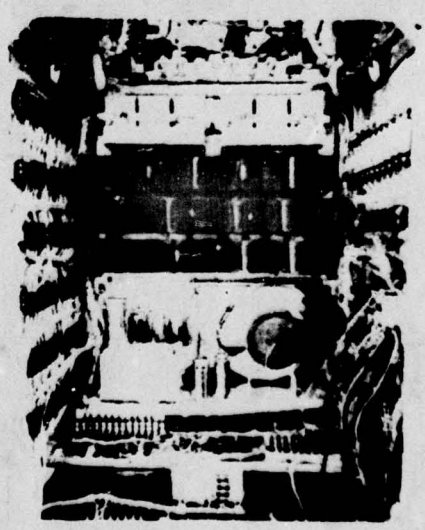


Figure 2

The top cover assembly is hinged at the back and opens to a vertical position (see Figure 3). This assembly contains the electronic components of the sonar target simulator which are also installed as plug-in units. The transformers and filter circuits of the DC power supplies are mounted on the bottom deck along with one servomechanism associated with the problem generator (see Figure 4). The power output tubes are mounted on the rear wall below the electronic components of the problem generator (see Figure 4). Four shock mounts are installed on the bottom of the trainer assembly and two on the back. The lower section of the two sides and back of the cabinet contain cable entrances which are provided with removable cover plates. All cabling from the associated sonar equipment and primary power source terminates on barrier type terminal strips installed on the inside walls of the cabinet.

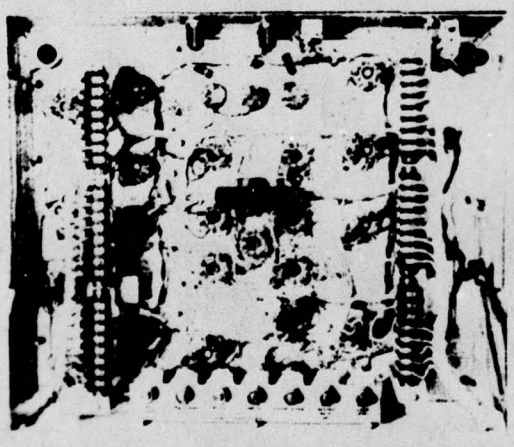


Figure 3

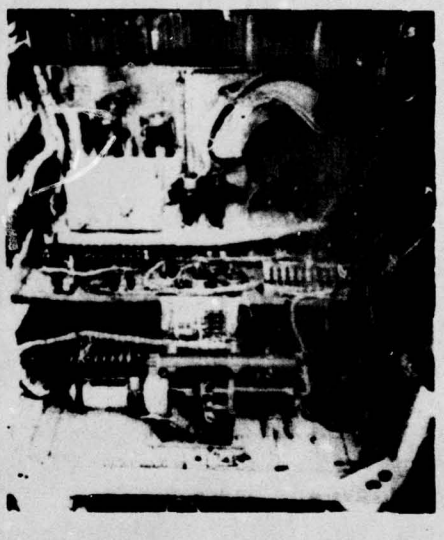


Figure 4

A 50-pole two position junction box switch is supplied as accessory equipment (see Figure 5). Cable connections are made to screw type terminals on the switch sections. The switch assembly is contained within a rectangular steel box with two mounting brackets welded to one side.

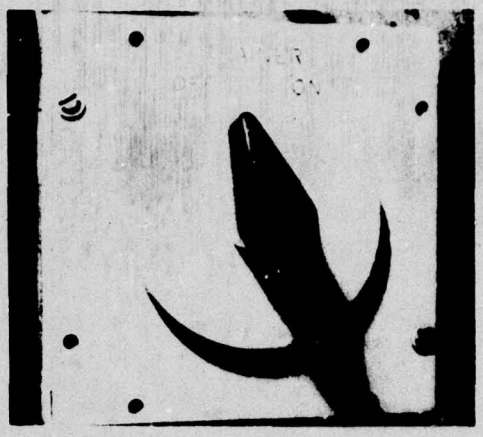


Figure 5

4. A bridge warning light, to inform the OOD that the trainer is in use, was designed as part of the equipment but was not provided. A problem reproducer was also a designed part of the trainer but was not included with the model tested. The reproducer will convert anti-submarine attack data recorded on magnetic tape into appropriate inputs for the sonar target simulator.

5. The equipment under test is a pre-production model and is designed to operate in conjunction with AN/SQS-1, AN/SQS-10, AN/SQS-11 or QHBa scanning sonar installations aboard ship. The trainer assembly cabinet measures 38-5/8 inches high, 18-19/32 inches wide, 18-7/16 inches deep and weighs 325 pounds. The junction box switch measures 6-1/2 inches high, 8-3/4 inches wide, 17-1/4 inches long, and weighs 13 pounds. The complete AN/SQS-T3 system (trainer assembly and two junction box switches), requires a space of approximately 8-3/4 cubic feet and weighs 351 pounds. It is manufactured by the Technical Development Corporation of Culver City, California, at a cost of approximately $10,000 per unit, under contract number NObsr-63163, of 23 December 1952. The system requires one operator to maneuver the synthetic target and, if necessary, own ship.

6. In its present form, the equipment is designed to perform the following functions:

a. Provide operator training when moored or at sea.

b. Provide team training when moored or at sea.

7. The trainer is designed to provide realistic target information, including bearing and bearing drift, range and range rate, doppler and target aspect. The trainer is designed so as not to interfere with the normal operation of the ship's sonar equipment other than presenting a simulated target. The remaining elements of the sonar presentation, such as wakes, reverberations, ship's noise, water noise, surface effects, and bottom echoes, are those actually detected by the ship's sonar equipment. The basic difference between the AN/SQS-T3 and the AN/UQS-T1 is that the AN/SQS-T3 utilizes the actual background noises and non-submarine echoes of the sonar equipment instead of simulating these effects. This greatly reduces the complexity of the equipment.

8. The AN/SQS-T3 Shipboard Sonar Trainer is capable of providing own ship motion inputs to the DRT. An additional junction box switch was installed in CIC to permit selection of either trainer or DRA inputs to the DRT. This was done so that trainer problems could be conducted underway without interfering with the normal operation of the ship's DRT.

TESTS

1. All tests at sea and in port were conducted with the AN/SQS-T3 Shipboard Sonar Trainer utilizing the AN/SQS-11a sonar, in USS FRANCIS M. ROBINSON (EDE 220). Runs at sea were conducted in deep water (over 200 fathoms). Sea states from zero to three plus were encountered with sonar conditions generally good (MIKE pattern with layer depth from 30 to 105 feet, and range at periscope depth from 1300 to 2200 yards).

2. Runs at sea were made with the synthetic submarine target approximately 200 yards from the actual target echo on the same course and speed. Photographs of the video presentation (typical samples of which are included as enclosures 2 and 3) were taken every "ping" and the audio signals were recorded on a magnetic tape. Audio signals from the synthetic submarine target were analyzed as to doppler and echo quality in comparison with the actual submarine target echoes. On all runs there was a continuous change in target bearing, range and aspect. Own ship's speed, target speed and target depth were varied on different runs. Two runs were devised so that the submarine changed course, speed and depth at specific times throughout the run while the A/S ship changed course and speed at designated times. On these two latter runs, which started outside of sonar range, the synthetic submarine target and the actual submarine made the runs at different times and the video presentation photographs were compared. No audio comparison was made on these runs.

3. Throughout all runs, with and without the trainer in use, a study was made of the sonar operator's use of his equipment controls. These results were compared to note if any difference existed in operator technique attributable to the trainer. At the same time a comparison was made to determine if the trainer had any effect on the material performance of the sonar.

4. An estimate of the utility of the trainer in ASW search, tracking and attack techniques and procedures as both an operator and a team trainer was made by officers and enlisted instructors from the Fleet Sonar School, Key West, Florida, as well as shipboard and project personnel.

RESULTS AND DISCUSSION

1. The video presentation does not accurately portray all the characteristics peculiar to an actual submarine echo.

a. The trainer target has the following characteristics which differ significantly from an actual submarine echo.

(1) The synthetic target is considerably more stable in size and recurrance than an actual submarine "pip". A random fader circuit, part of the trainer circuitry, varies the size of the target in proportion to the amount of reverberations received back, but does not vary the size sufficiently nor does it ever completely cut out the target echo. The general behavior of the synthetic target is "too good".

(2) None of the three available pulse lengths on the AN/SQS-11A sonar vary the trainer target size perceptibly. The "pip shape" of the trainer target generally appears as a medium pulse length beam aspect target.

(3) The intensity of the synthetic target does not vary realistically with respect to range at ranges greater than 500 yards. Even though there is a "range of the day" setting which denies sonar contact on the synthetic target beyond that range, the synthetic target when acquired, is noticeably bright and continues so throughout the run.

(4) Whereas the sonar gain control may be turned up high enough to blend the trainer target in with the reverberations and background noise, lowering the gain does not sufficiently decrease the trainer target size. The trainer target remains on the scope even when the gain is turned low enough to eliminate all reverberations and background noise.

(5) There is no means of simulating submarine wakes with the synthetic target.

b. The trainer target has the following characteristics which closely simulate a video presentation of an actual submarine.

(1) Varying the depth of the trainer simulated target causes a realistic loss of contact due to short range. Contact was regained upon switching to "MCC", and was again lost if trainer was deep and A/S ship passed close aboard.

(2) The trainer target on "difference" brightening, presented an appearance similar to an actual submarine, except that changing the pulse length or gain control had a neglible effect on the trainer target.

(3) At shorter ranges (500 yard scale and MCC) the trainer target closely approximated an actual submarine in all respects.

2. The audio presentation does not accurately portray all the characteristics peculiar to an actual submarine echo.

a. The trainer target echo has the following characteristics which differ significantly from an actual submarine echo.

(1) The sonar gain control does not have any perceptible effect on the gain of the trainer. From target acquisition to the loss of contact due to short range, the intensity of the synthetic audio signal is not noticeably affected by any change in the sonar gain control.

(2) A shift between the three available pulse lengths does not noticeably vary the echo quality of the synthetic audio signal as it does with an actual submarine echo. The echo quality of the synthetic audio signal closely approximates a beam aspect medium pulse length echo throughout. It is this steady tone effect that "audio wise" identifies the synthetic signal.

(3) The range attenuation of the audio signal is insufficient. From the time of target acquisition down to the change to the 1,000 yard scale, no noticeable variation in signal strength of the synthetic target echo is apparent. Below 500 yards this deficiency is not apparent.

b. The trainer target echo has the following characteristics which closely simulate an audio signal from an actual submarine.

(1) The doppler effect of the synthetic target echo realistically changes with changes of target aspect and speed. The doppler changes sufficiently to provide realistic training to the operator in pitch determination. However, when compared with the doppler of an actual submarine echo, and the two are heard close together, there is a slight difference in echo quality.

(2) At the shorter ranges (500 yard scale and MCC) the synthetic audio signal closely approximates that of an actual submarine echo. At these shorter ranges the synthetic echo blends in more with the reverberations and background noises producing a more realistic audio signal. The flat mushy echo quality of an actual submarine echo at short ranges is closely simulated by the trainer.

3. The range recorder traces of the synthetic target do not accurately portray all the characteristics peculiar to an actual submarine. These effects were noted on both the OKA-1 range recorder and the Tactical Range Recorder.

a. The synthetic target trace does not permit aspect determination. This is the greatest deficiency of target simulation on the range recorders because training of operators in determination of target aspect is denied. The length of the synthetic target trace does not vary realistically with aspect, nor are wake effects reproduced.

b. The sonar gain control has very little effect on the darkness of the traces of the simulated target. From a gain setting of from "2 to 3" increasing until reverberations and background noises have masked the trace completely, little difference is noted in the darkness of the synthetic target trace of the range recorder.

c. None of the three available pulse lengths vary the simulated target length significantly. The usual appearance is that of a beam aspect, medium pulse length target.

4. The trainer does not afford operator training in ASW search, in tracking and attack techniques and procedures.

a. Because of the high video level from the synthetic target, an AN/SQS-11A gain setting of from "2 to 3" gives full signal strength. Increasing the gain control only brings in more reverberations and background noise until the scope is saturated, causing no change in the synthetic target's video strength. The audio signal from the synthetic target remains constant and cannot be varied by use of either the sonar gain control or pulse length.

b. The operator does receive beneficial training in the tracking of a moving target Since target speed may be varied from zero to fifty knots and own ship speed may be varied the same amount, excellent training in the steady tracking of either high or low range rate targets may be accomplished.

5. The trainer is excellent for team training in single ship ASW search, tracking and attack techniques and procedures; no provision is made for team training in coordinated attacks.

a. Because the trainer provides inputs to the range recorder and the DRT, team training in port, less classification aspects, may be carried out more realistically by members of the team using their own equipment in their own spaces as compared to using the attack teacher facilities afforded by tenders or shore based activities. Underway in formation, training can be conducted when the noise level and work load approximates actual conditions in the "CIC" of the A/S ship The amount of actual team training that may be accomplished should be higher aboard a vessel equipped with the trainer than on a vessel which must depend on other activities for "attack teacher" periods.

b. The trainer was not designed to provide team training in dual or multi-ship search attack techniques and procedures. Due to the complexity and current importance of a dual ship problem, it is highly desirable that team training also include this phase. It appears feasible to include portable auxiliary equipment to permit dual ship

team training in port when moored alongside in a nest. It is believed the following equipment would suffice:

(1) A small computer to receive initial range and bearing of ship A from ship B and continuous courses and speeds of ships A and B as generated by the trainer. The output of the computer will be continuous ranges and bearings of each ship from the other. This provides for generation of simulated radar information.

(2) Provision for slaving the synthetic target maneuvers on one trainer to that of the other trainer.

(3) Suitable portable leads, sound powered phone and voice radio circuits.

7. The trainer appears to be compatible with any scanning sonar now in service use.

a. The synthetic audio and video signals are introduced directly into the loud speaker and cathode ray tube respectively, hence are independent of receiver characteristics of the installed sonar.

b. References (d) and (e) discuss tests, equipment and procedures for determination of figure-of-merit. The synthetic signals used in determination of figure-of-merit are introduced into the preamplifiers, hence are dependent upon the receiver characteristics of the installed sonar.

8. The material performance of the AN/SQS-11A sonar was not adversely affected by the installation of the AN/SQS-T3 trainer. No material casualties to the sonar were caused by the operation of the trainer.

9. The material performance of the AN/SQS-T3 trainer was satisfactory.

a. Installation and initial adjustment. No unusual difficulties were encountered during the installation. Installation instructions were considered adequate. The trainer was received in a serviceable condition and no special materials or equipment were required for installation. A factory representative for Technical Development Corporation was present during the entire installation and equipment check-out period. The trainer was installed in Sonar Control for ease of making adjustments of the audio and video inputs of the trainer. However, it is suggested that in future installations the trainer be installed elsewhere, so that the A/S team will not be forewarned of the use of the trainer. Any position unexposed to the weather which obtains a reasonable balance between requirements for convenience, weight and moment compensation, habitability, length of cable runs and cost, would be entirely satisfactory. Such remote location will require sound powered telephone communications to a remote sonar scope location, for synthetic target conning and trainer adjustments.

b. Mechanical characteristics. The trainer is a small (39" x 19" x 18"), compact (325 pounds), relatively simple piece of equipment affording easy access to all components. The trainer is of rugged construction. It is not weatherproof. The equipment shows evidence of excellent workmanship throughout. Adequate controls are provided. Illumination is satisfactory except for turn, acceleration and target depth dials.

c. Electrical characteristics. No adverse effects to the equipment were observed due to either ships motion, high temperatures and humidity, or line voltage and frequency variation. The equipment does not emit an undesirable amount of light or vibration. The heat generated by the equipment was not measured, but did not appear significant. No difficulty was observed in making or maintaining adjustment of the equipment with the controls provided. The equipment appears to have sufficient interlocks for the protection of personnel. There was no evidence of operation of vacuum tubes or other components beyond their rated capacity.

d. Maintenance. There is adequate access to all units of the trainer for inspection, removal, testing and/or repair. No special test equipment or tools are required for maintenance. The instruction book used was not completely up to date with all current changes to the circuitry. The spare parts list included no Navy stock numbers. After initial check-out and during the period of tests only one material casualty occurred. This necessitated replacement of the field winding of a motor generator servo.

e. Personnel & Habitability. The trainer requires one operator to maneuver the synthetic target and, if necessary, own ship simulation. Maintenance requirements did not appear excessive during the operational period with maintenance being accomplished by an enlisted technician briefed during the installation by the factory representative. No adverse effects on habitability were noted.

CONCLUSIONS

As a result of the tests conducted it is concluded that:

1. The trainer affords excellent training for the A/S team in single ship attacks.

2. Except for training in tracking, the device is inadequate for sonar and range recorder operator training.

3. The following deficiencies exist in the trainer, but appear remedial by relatively minor modification of the present design:

a. Insufficient variation of signal strength with range.

b. Insufficient variation in trace length, audio echo, and video pip with target aspect.

c. Insufficient variation in trace length, audio echo, and video pip with pulse length.

d. Poor performance of the random fader circuit.

e. Inadequate slaving of generated signal strength to the sonar gain control.

4. If the deficiencies of 3(a) and (b) above were corrected the device would be an adequate operator trainer; if all the deficiencies of 3 above were corrected the device would be an excellent operator trainer.

5. The introduction of the synthetic target signal into an operating sonar, using the elements common to the sonar (wake, reverberations, ships and water noises, surface effects and bottom echoes), is an excellent design feature and greatly reduces the size, cost and complexity of the A/S trainer.

6. No adverse effect on the operator controls of the AN/SQS-11A Sonar result when the trainer is in use.

7. The material performance of the AN/SQS-11A Sonar is not adversely affected by use of the trainer.

8. Availability of ar adequate trainer of the T3 type would lead to an important improvement in A/S readiness in the Fleet, and would reduce the requirements for AN/UQS-T1 type trainer installation in tenders.

9. The trainer in its present form is not suitable for use in determination of figure-of-merit.

RECOMMENDATIONS

As a result of tests conducted it is recommended that:

1. The present trainer be modified to provide reasonably realistic variation of synthetic signal strength with range, and signal duration with pulse length.

2. If practicable, modify the present model to provide the following:

   a. Improved slaving of synthetic signal strength to sonar gain control.

   b. Reasonably realistic variation of signal duration with target aspect.

   c. Improved random fading circuit.

3. Subject to successful completion of engineering tests, the trainer, as modified, be accepted for service use.

4. That the modified trainer be issued initially to major ASW vessels in such numbers that each squadron will have one trainer for each type of scanning sonar in the squadron, but not less than one trainer per division.

5. Development of shipboard trainers continue, leading to:

   a. Provision of a figure-of-merit determination feature.

   b. Provision of portable auxiliary components for two-ship attack team training for ships moored in nest.

   c. Improved realism in target simulation; particularly provision of wake effects and hydrophone noise, if practicable without undue increase in size and complexity.

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON 25, D. C.

Op-373/ic
Ser 937P37
3 Sep 1952

CONFIDENTIAL

From: Chief of Naval Operations
To: Commander Operational Development Force

Subj: Project Op/S276/S68, "Evaluate the AN/SQS-T3 Shipboard Sonar Trainer"; assignment of

Ref: (a) BUSHIPS ltr 848-156 of 9 June 1952

Encl: (1) Copy of project details

1. Project Op/S276/S68, "Evaluate the AN/SQS-T3 Shipboard Sonar Trainer", is hereby assigned to Commander Operational Development Force for prosecution with priority "A".

2. The contents of reference (a) are included in enclosure (1) as project details.

3. The Chief, Bureau of Ships is directed to ship the AN/SQS-T3 equipment to the Commanding Officer, Surface Anti-Submarine Development Detachment for installation in a ship to be designated by the Commander Operational Development Force.

4. Authority is granted to communicate directly with the requisite commands and agencies in the prosecution of this project.

M. E. CURTS
By direction

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Op-374
Op-371C
Op-371U

Authenticated

/s/D. G. Dockum
D. G. DOCKUM
Commander, USN

Project Op/S276/S68 Priority "A"

Evaluate the AN/SQS-T3 Shipboard Sonar Trainer

PURPOSE

1. The purpose of this project is to determine the suitability of the AN/SQS-T3 Shipboard Sonar Trainer as an operator and team trainer.

SCOPE OF TESTS

1. Determine the suitability of the equipment for shipboard installation.

2. Determine that the trainer provides a realistic simulation of sonar echoes from a moving synthetic submarine target to the audio and video inputs of a conventional scanning sonar equipment.

3. Determine that echo pulse lengths vary in proportion to normal pulse lengths of sonar equipment as modified by target aspect.

4. Determine that simulated echoes attenuate with range in the same manner as live echoes.

5. Determine that minimum detectable r nges of the simulated target vary in proportion to depth of target.

6. Determine that target width as observed on the sonar equipment, both audibly and visually, varies according to range of the target and characteristics of sonar equipment used.

7. Determine that all sonar equipment controls operate in a normal manner.

8. Determine the value of the device as a sonar operator trainer in the techniques of sonar search and attack procedures.

9. Determine the value of the device as a sonar team trainer in the techniques of sonar search and attack procedure.

DESCRIPTION OF EQUIPMENT

1. The AN/SQS-T3 consists of a scanning sonar simulated transducer and a sonar problem generator manufactured by Technical Development Corporation, 4060 Ince Blvd. Culver City, Calif. The estimated cost for 115 equipments and spares is $2,314,375. (A sonar problem reproducer is also a part of the AN/SQS-T3, which is intended to be evaluated at a later date. This unit uses tape recordings). The scanning sonar simulated transducer may be used with either the problem generator, which requires manual inputs, or the problem reproducer, which uses tape recordings for problem generation.

2. Upon completion of shipboard tests, the equipment is to be removed and shipped to the U. S. Navy Electronics Laboratory for final acceptability tests.

STATUS OF EQUIPMENT

1. A preproduction model of the AN/SQS-T3 will be made available by BUSHIPS.

REMARKS

1. The trainer can be installed by ship's force with limited assistance of tender personnel.

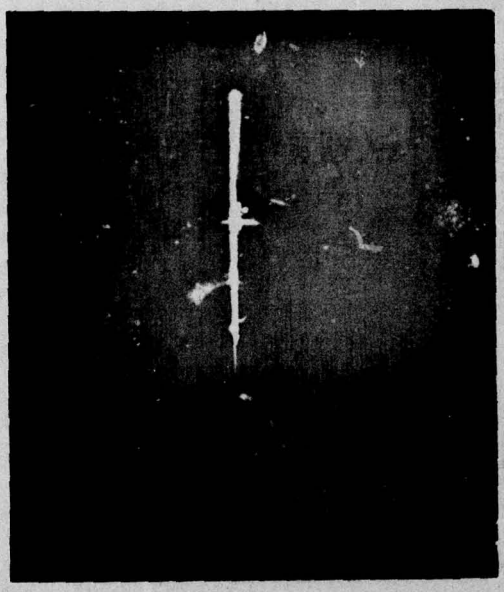
2. It is estimated that twenty operating days will be required to complete the necessary tests.

3. Letter reports are desired and the final report is required prior to April 1953, because Fiscal '53 funds are allocated to this trainer.

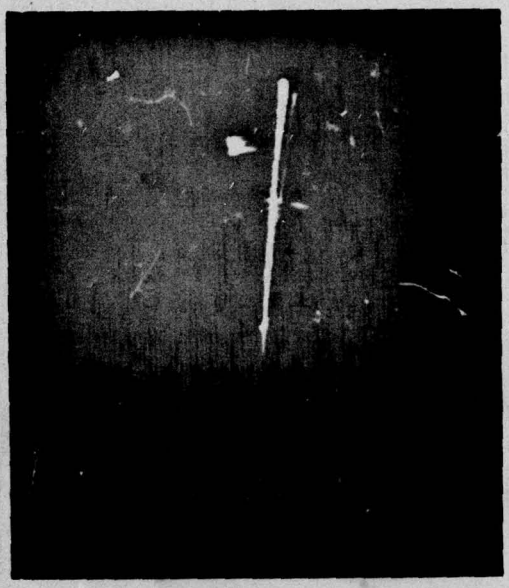
4. Liaison for this project will be:

LCDR John G. Wallace, Bureau of Ships, Navy Dept., Wash., D.C.
Mr. E.J. Campton, Bureau of Ships, Navy Dept., Wash., D.C.

These photographs of the PPI display were taken in sequence at short range on MCC. Both targets present a beam aspect at speed 9 knots, depth 250 feet. A/S ship is at speed 15 knots. The run commenced with operator holding contact on submarine, quarter aspect, distant 2000 yards and synthetic target presenting same aspect at approximately 20 degrees bearing difference and range 2300 yards. Operator held contact on submarine throughout the run until this series of photographs, when the actual submarine faded and the synthetic target was accepted as the actual submarine.



Actual submarine, beam aspect, synthetic target being repositioned

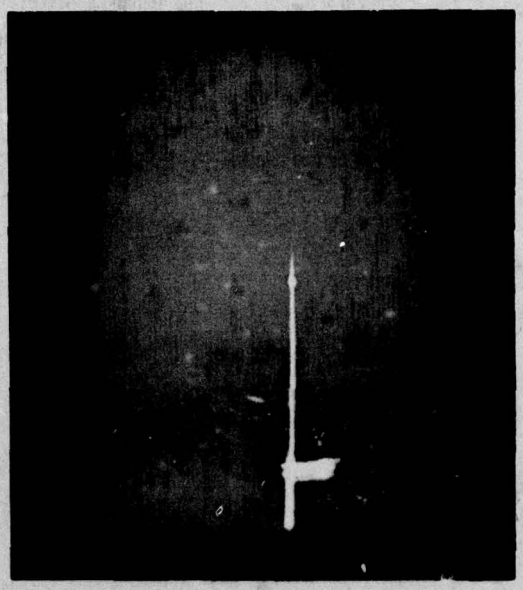


Actual submarine and synthetic target, beam aspect

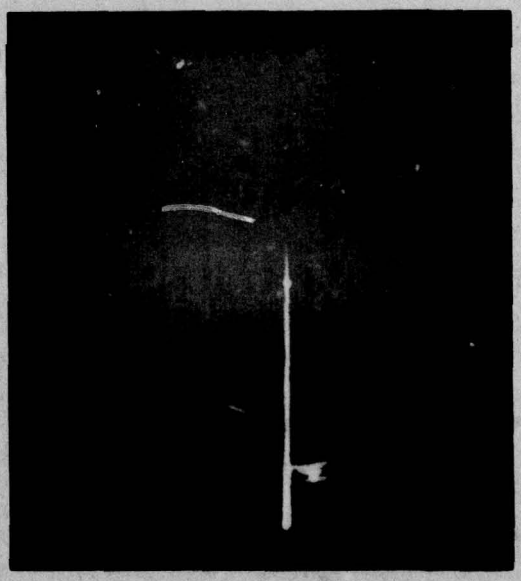
Actual submarine commencing to fade.

Actual submarine faded, wake reverberations present, operator commencing investigation of synthetic target as possible actual submarine.

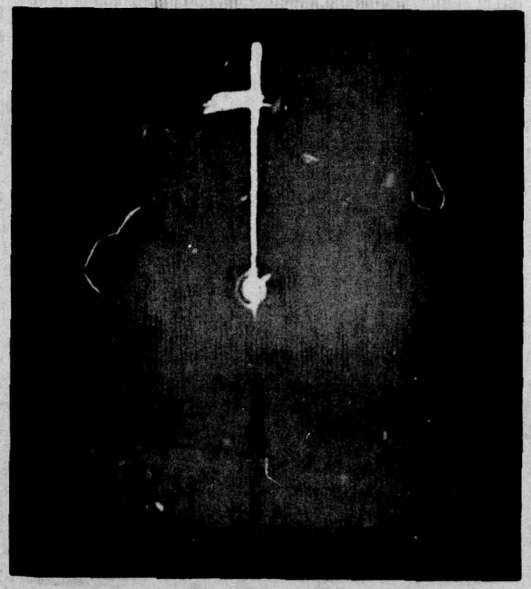
Actual submarine faded, operator accepting synthetic target as actual submarine.



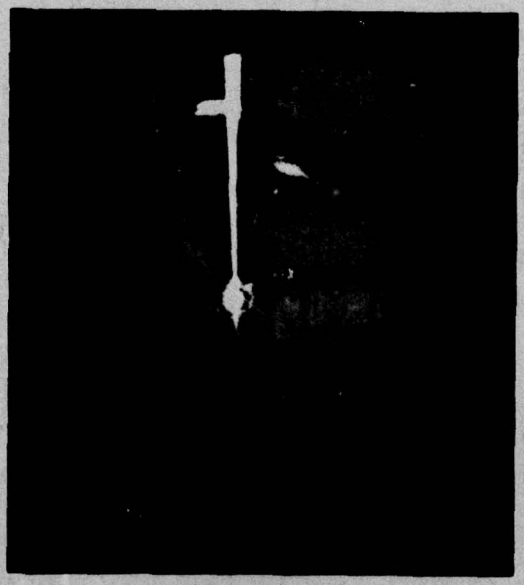
Actual submarine faded, operator has accepted synthetic target as actual submarine.



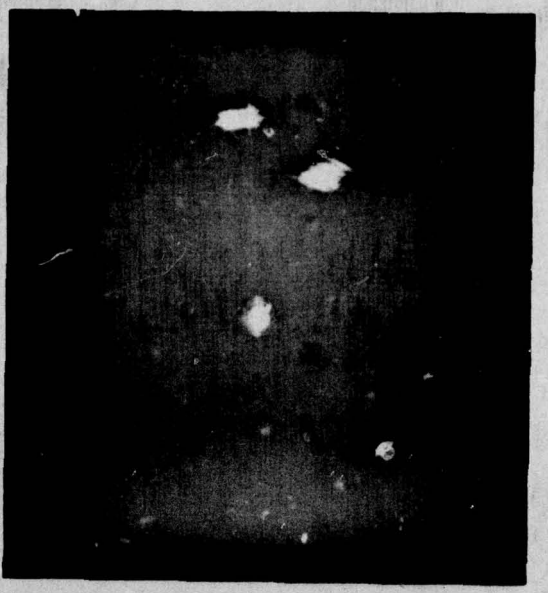
Actual submarine still faded, operator still accepting synthetic target as actual submarine.



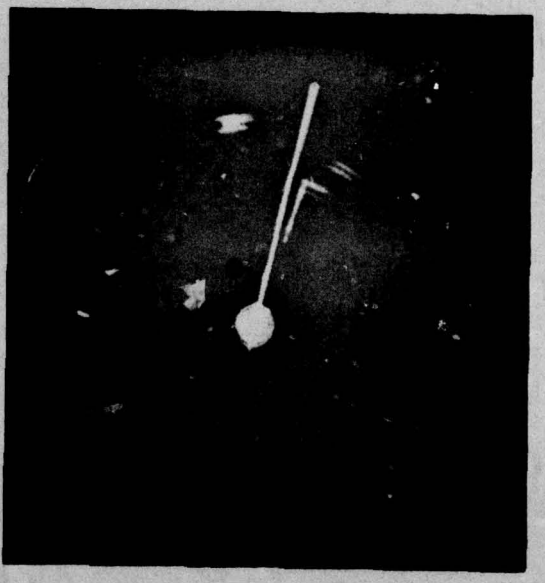
Actual submarine coming back in on scope. Operator still accepting synthetic target as actual submarine



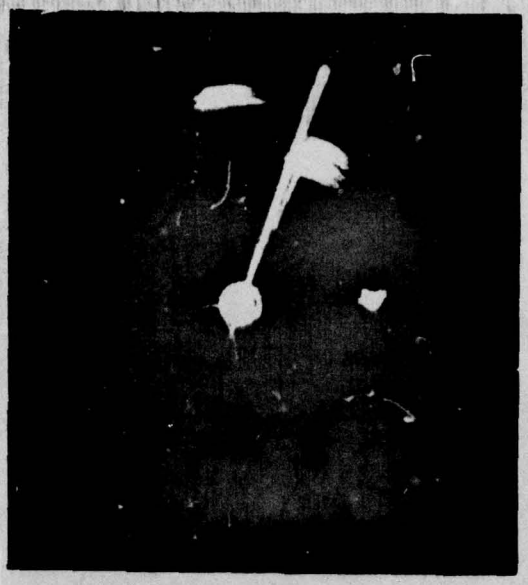
Actual submarine back on scope with wake reverberations present. Operator commencing to re-evaluate targets.



Operator still re-evaluating both targets.



Operator accepts actual submarine as correct target.

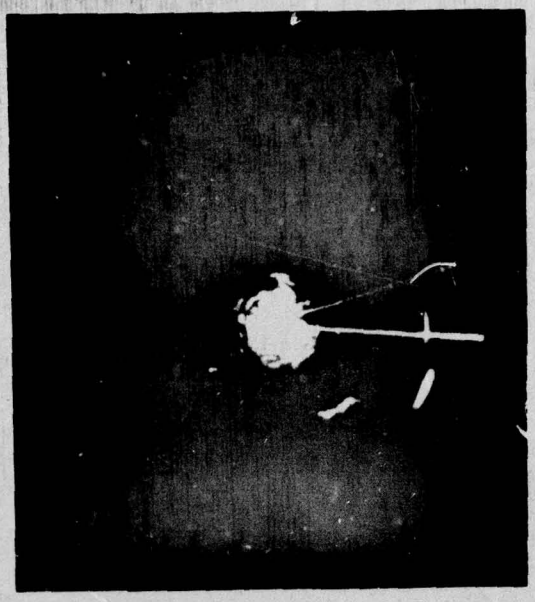


Operator back on correct target.

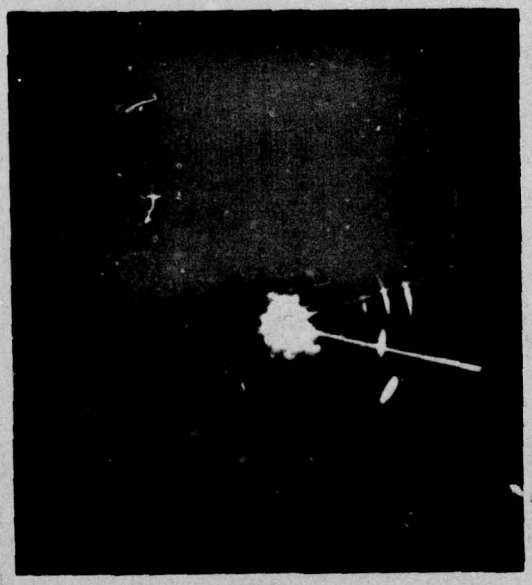
Cursor on actual submarine, synthetic target east of actual submarine. MCC, beam aspect, range 200 yards, depth 300 feet, speed 9 knots.

Cursor on actual submarine, synthetic target south-west of actual submarine. 1000 yard range scale, beam aspect, range 200 yards, depth 200 feet, speed 5 knots.

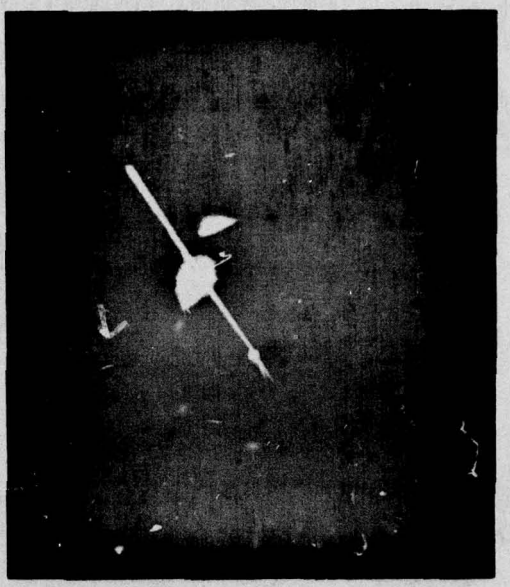
Cursor on actual submarine, synthetic target south of actual submarine. 3000 yard range scale, bow aspect, range 1500 yards, depth 150 feet, speed 3 knots.



Cursor on actual submarine, synthetic target south of actual submarine. 3000 yard range scale, bow aspect, range 1000 yards, depth 150 feet, speed 3 knots.

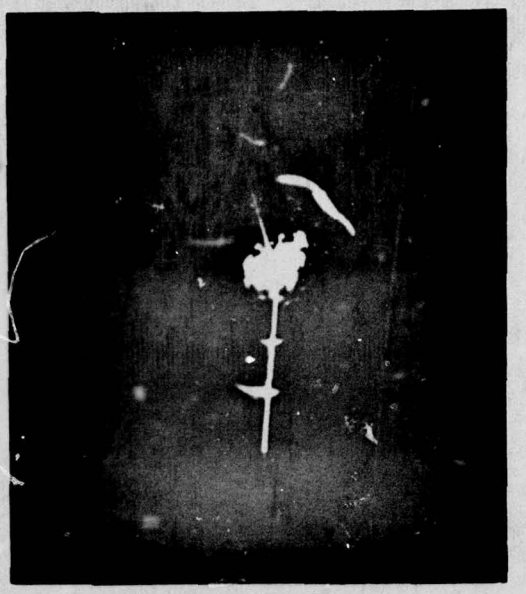


Cursor on actual subr arine, synthetic target north of actual submarine. MCC, bow aspect, range 500 yards, depth 300 feet, speed 9 knots.



Cursor on actual submarine, synthetic target north-east of actual submarine. MCC, bow aspect, range 300 yards, depth 300 feet, speed 9 knots.

Cursor on both actual submarine and synthetic target. Synthetic target south of actual submarine. 3000 yard range scale, beam aspect, range 1000 yards, depth 150 feet, speed 3 knots.



Cursor on actual submarine, synthetic target west of actual submarine. MCC, beam aspect, range 400 yards, depth 300 feet, speed 9 knots.

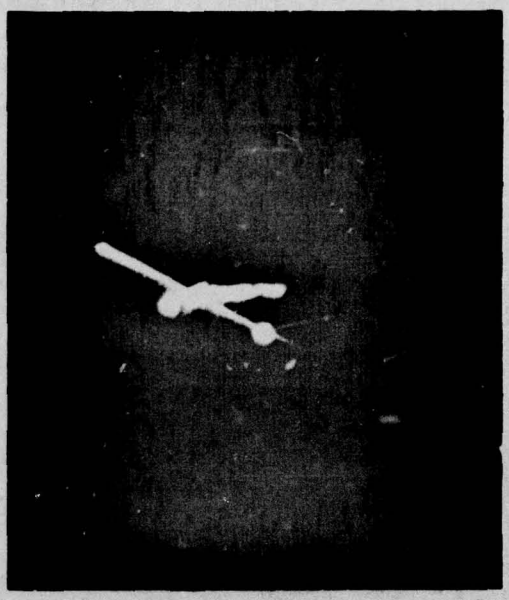
Cursor on actual submarine, synthetic target south-east of actual submarine. 3000 yard range scale, quarter aspect, range 1800 yards, depth 250 feet, speed 9 knots.

Cursor on actual submarine, synthetic target south-west of actual submarine. 3000 yard range scale, quarter aspect, range 1000 yards, depth 250 feet, speed 6 knots.

Cursor on actual submarine, synthetic target north of actual submarine. 3000 yard range scale, difference brightening, quarter aspect, range 800 yards, depth 200 feet, speed 7 knots. Note large amount of wake astern of actual submarine.

Cursor on actual submarine, synthetic target south of actual submarine. 1000 yard range scale, quarter aspect, range 400 yards, depth 150 feet, speed 3 knots.

Cursor on actual submarine, synthetic target west of actual submarine. 1000 yard scale, quarter aspect, range 350 yards, depth 200 feet, speed 5 knots. Again note large wake effect on actual submarine.



Cursor on actual submarine, synthetic target west of actual submarine. MCC, quarter aspect, range 250 yards, depth 200 feet, speed 5 knots.